DESIGN AND FABRICATE A WORKING ROTARY VANE COMPRESSOR SIMULATION RIG

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A report submitted in partial fulfilment of the requirements
for the award of the degree of
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SUPERVISOR'S DECLARATION

I hereby declare that i have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering

Signature:
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Date: ….. NOVEMBER 2008

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature:
Name: SHAHIDAN BIN HASSAN
Date: ….. NOVEMBER 2008

DEDICATION

First of all, I would like to show my expression of gratitude to Allah s.w.t whose guidance, help and grace was instrumental in making this humble work a reality. This dedication goes to my beloved parent, family and friend, without whom and his/her effort, my pursuit of higher education would not have been possible and I would not have had the chance to study for a mechanical course. Also to my supervisor, Muhamad Imran bin Mohmad Sairaji and mechanical staff, without whose wise suggestions helpful guidance and direct assistance, it could have neither got off the ground nor ever been complete. Thanks a lot to my friend in their support and advice towards this project.Thanks to all for your enduring patience and continuous encouragement.

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In the praise of Almighty Allah, the beneficent and Merciful-who showed the path of righteousness and blessed me to get the strength to embark upon this task of peeping into the realms of facts and events.This project was conducted under supervision of Muhamad Imran bin Mohmad Sairajiin University Malaysia Pahang (UMP) . I am very grateful to him for his patience and his constructive comment that enriched this research project. His time and efforts have been a great contribution during the preparation of this thesis that cannot be forgotten for ever.I would like to acknowledge with much appreciation the crucial role of the staff in Mechanical Laboratory, for their valuable comments, sharing their time and knowledge on this research project was carried out and giving a permission to use all the necessary tools in the laboratory.I also gratefully acknowledge the assistance of everybody who helped in the execution of this project in UMP. I also thank to all Mechanical students for their friendship and help when thinking through problem and for sharing their knowledge of experimental apparatus and computer systems. Finally, I would like to thanks to my family for their continuous support and confidence in my effort.

ABSTRACT

The idea to to design and fabricate a working rotary vane compressor simulation rig is come from supervisor that gives me this title and task for this project. To design and fabricated this rotary vane compressor simulation rig, it must be compare with other product that maybe available in the market. First, get an idea from internet, magazine, newspaper or other from available data. Form there the information and idea to design and fabricated can be created.Whole project involves various methods such as collecting data, concept design and fabrication process. The whole project involved various method and process that usually use in engineering such as concept design, analysis process and lastly fabrication process. This final year project takes one semester to complete. This project is individual project and must be done within this semester. In this project, students must able apply all knowledge during their studies in this Diploma of Mechanical Engineering course. Overall from this project, time management and discipline is important to make sure this project goes smooth as plan and done at correct time.

ABSTRAK

Idea untuk menghasilkan dan membina aturan simulasi putaran bilah pemampat ini datang daripada penyelia yang memberi saya tajuk dan tugasan untuk projek ini. Untuk merekabentuk dan pembinaan putaran bilah pemampat ini, ia hendaklah dibandingkan dengan produk lain yang mungkin berada dalam pasaran. Langkah pertama, dapatkan maklumat daripada internet, majalah, suratkhabar atau daripada sumber yang lain. Keseluruhan projek melibatkan pelbagai cara atau kaedah seperti mengumpulan data, rekabentuk konsep dan proses membina. Kaedah yang selalu yang digunakan dalam kejuruteraan seperti proses analisis juga digunakan. Projek akhir tahun ini mengambil satu semester untuk disiapkan. Projek ini adalah projek individu dan mesti disiapkan dalam semester ini. Didalam projek ini, pelajar mesti berupaya menggunakan segala pengetahuan yang mereka perolehi semasa pembelajaran mereka di dalam kursus Diploma Kejuruteraan Mekanikal ini. Secara keseluruhan daripada projek ini, pengurusan masa dan disiplin adalah penting dalam memastikan projek berjalan lancar dan siap tepat pada waktunya.

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CHAPTER 1

INTRODUCTION

1.1 Project Title

The title of this project is “Rotary vane compressor simulation rig”. Fabrication of the rotary vane compressor simulation rig is concern to strength, durability, and easy to understand .New concept require to improve durability and easy to understand.

1.2 Project Synopsis

Rotary vane compressor is one of the compressor type that commonly used for Proton’s car air conditioning system. This project is to fabricate a Rotary Vane Compressor housing using acrylic and the rig using flaxy glass. This will able viewer to see a working compressor and help them understand the basic principle of Wobble Plate Compressor.

1.3 Project Background

Rotary vane compressors are latest technology compressors, which incorporate simple, dependable and rotating slide vane technology to deliver sustained performance pressures or vacuums for off-loading liquids. A rotary vane compressor is fitted with an high performance inlet air filter to takes in atmospheric air and the compressed air is discharged at a higher pressure into the cargo tank.

Rotary vane compressors provide efficient and quiet delivery of oil-free gas or air. These compressors combine latest technology and advanced design to give maximum performance with minimum maintenance and effort.

The rotor, cylinder and side plates define sealing space at respective ends of which are provided suction bores and discharge bores.

1.4 Project Objective

Project objective divide by two .It is general objective and specific objective for the title of the project.

1.4.1 General Objective

Diploma final years project objective is to practice knowledge and skill of the student that have been gathered before in solving problem using academic research to born an engineer that have enough knowledge and skill. This project also important to train an increase the student capability to get know, research, data gathering, analysis making and solve a problem by research or scientific research.

The project also will educate the student in communication like in presentation and educate them to define their research in presentation. The project also will generate students that have capability to make good research report in thesis form or technical writing. This project also can produce an train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the experiences and knowledge. This project also important to generate and increase interest in research work field.

1.4.2 Specific Project Objective

The objectives for this project are:

1. To design and fabricate a working rotary vane compressor simulation rig.
2. To understand the basic principle rotary vane compressor.
3. Will able viewer to see a working compressor.

1.5 Problem Statement

Now day, people are facing problem while they need to know simulation rig about rotary vane compressor. Thus, with the design and fabricate a working rotary vane compressor simulation rig, I hope that it can contribute ideas how to solve this problem.

1.6 Project Scope

In order to finish this project require precise scope of work and proper plan need to be followed because this project must through various process before it would be produce. Beside that this project title is new idea which is come from instructor engineer in lab and as the knowledge isn't entirely covered in classes or lab. So it give us advantages to learn new process to produce this product and absolutely we could find lot of advantages neither we are realized or not. These are scope of work in this project.

These scopes help me to be focused and know about my job. The scopes are:

1. Literature review about rotary vane compressor
2. Design the housing of the rotary vane compressor use solid work& AutoCAD.
3. Fabricate the project using flaxy glass.
4. Test project and make report.

It is time where the soft skill e.g. punctuality, self discipline, time management and problem solving have been practiced because the project highly depend on the effectiveness of all the skill as much as the knowledge we have learnt.

1.7 Project Gantt chart

PROJECT ACTIVITIES		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
	Plan														
Attend briefing the final year project by lecturer															
	Actual														
	Plan														
Get title final year project from lecterur															
	Actual														
	Plan														
Do some planning, Gantt chart, Flow chart															
	Actual														
	Plan														
Literature review and gather imformation															
	Actual														
	Plan														
Dimension and sketchy															
	Actual														
	Plan														
Progress Presentation															
	Actual														
	Plan														
Fabricate the design that has been choose															
	Actual														
	Plan														
Continue with the fabrication															
	Actual														
	Plan														
Assembly															
	Actual														
	Plan														
Finalize the project															
	Actual														
	Plan														
Final report															
	Actual														
	Plan														
Final presentation															
	Actual														

Table 1.1: Project Gantt chart

This project will began with investigation and makes a research and literature review from internet. Reference books, supervisor and other relevant academic material that related to this project. To make this project more accurate and suitable, every week discuss with supervisor and continue detail research about rotary vane compressor. At the same time, some schedule management planning for this project is planned to make sure the project achieve its project and make sure all activity due to schedule.

After get all information from literature review. Make a sketching model. The sketching done using sketching at A4 size paper and convert to 3D drawing using solid work software. The design of the housing must be suitable with the objective.

The next task is preparation of progress presentation and report writing. Beside that, the student receives aids from the supervisor about the presentation. The preparation of the presentation requires comment and correction from the supervisor. This week also must be acquisition of the material for this project. The material must be suitable to get finished project very well.

For week 7, start fabricates the project. The fabrication was finish at week 12. After that, next come assembly, finalize, testing, or do some correction from the model. This fabrication was finished no sharp on time in week 13. Then, the product must be evaluation in testing the model. So this week is to test the product to know the functional of the product is successful or not. This week also to improve the product if has any mistake and deformity.

Lastly, the final report writing and prepare the presentation. This takes about one week to arrange and accomplish. A report is guided by UMP thesis format and also guidance from supervisor. Due to all problems that student facing, the management have agreed to extend the time to submit a report and presentation. All task scheduled is take around fourteen weeks to complete.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter is present about literature review of rotary vane compressor fabrication process such as Milling, Cutting, Grinding, drilling and other else. Before fabrication process, the material selection is crucial. The selection of joining process is also important to get a product with better strength and durability. Literature review about machine is also important. It is include guide to setup the machine, type of machine suitable for fabrication process and advantages using this machine.

2.2 Rotary vane compressors

Figure 2.1: Rotary vane compressors

Rotary vane compressors are latest technology compressors, which incorporate simple, dependable and rotating slide vane technology to deliver sustained performance pressures or vacuums for off-loading liquids. A rotary vane compressor is fitted with a

high performance inlet air filter to takes in atmospheric air and the compressed air is discharged at a higher pressure into the cargo tank.

Rotary vane compressors provide efficient and quiet delivery of oil-free gas or air. These compressors combine latest technology and advanced design to give maximum performance with minimum maintenance and effort. Rotary vane compressors have found to be ideal for handling a comprehensive range of industrial gases, which include - propane, butane, butadiene, propylene, vinyl chloride, and chemical intermediates.

2.2.1 Applications

An important application of rotary vane compressors is in the replacement for pumps in transport applications, which involve corrosives, containment concerns, high standards of purity, complete evacuation of residual product and high performance with corrosive and hard to handle fluids.

2.2.2 Features and Benefits.

Some of the important features and benefits of rotary vane compressors include –

- Suitable for pressure discharge of difficult fluids.
- Ideal for applications where purity and containment are of high concern.
- Based on a small-bore design, which reduces the blade tip speed for longer life.
- Designed with hard-coated cast iron housing that provides greater durability and corrosion resistance than aluminum.
- Fitted with an inlet air filter to provide clean air to protect the unit
- Designed with a highly efficient turbo cooling fan system, which protects the unit from overheating.
- Available in hydraulic drive versions.
- A perfect combination of pressure relief/check valve, which reduces plumbing requirements and allows remote mounting for ease of maintenance

2.2.3 Concept

To get a better understanding of how they function, consider the air tool, a device with comparable function. In an air tool, compressed air enters the smallest compartment of the vane-housing at shop pressure, usually at 90 PSI or higher.

In so doing, it drives the vane mechanism inside the tool in a rotary motion. The compressed air is 'trying' to get from an area of high pressure back to atmosphere, thus moving the vanes as it drives to the exhaust port of the tool.

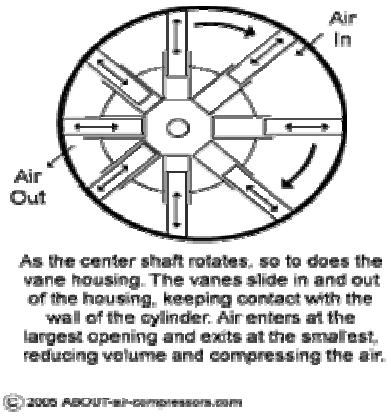

Figure 2.2: Concept of the rotary vane compressors

As the shaft in the vane-housing rotates, the vanes inserted into that housing slide in or out, depending on where they are in the cycle. Centrifugal force ensures that the vanes are always keeping contact with the inside of the outer cylinder, creating a seal. This forms air-tight compartments within the vane housing. Air flows from an area of high pressure to an area of low pressure, so the high pressure air in the small vane-compartment wants to get to the larger area vane, and ultimately, out. The shaft inside of the vane-housing extends through seals to the outside of the end of the tool, and is attached to tooling on the end. As a result, you get rotary motion of that tooling. The power that drives the air tool is compressed air.

The same principle works in the Rotary Vane Compressor, though, rather than compressed air being the power source to drive a shaft and do work, often it’s electricity, and the purpose is not to generate rotary motion of a shaft to drive a tool, but use the rotary motion of the vanes to compress air that you then can use to power a huge variety of compressed air-driven equipment. In-plant installations of Rotary Vane Compressors are most commonly driven by an electric motor.

Road site repair and building construction crews can use Rotary Vane Compressors too, these being powered by a gasoline, diesel or sometimes even a propane motor; this due to this industry's requirements for a portable compressor. The external power supply for the Rotary Vane Compressor drives a shaft inside the barrel of the compressor and at the centre of the vane-housing. This rotates the vane-housing.

The vanes, installed in the eccentrically located centre housing, are able to slide in and out and the vane's length depends on where they are in relation to the outer barrel. Centrifugal force presses the vanes against the inner-wall of the outer barrel. This seals each vane against the outer surface, creating relatively "air tight" compartments within. Where the volume between the vanes is largest, air enters the vane-housing through an inlet valve. As the center shaft continues to rotate, and since its off-center to the cylinder, the succeeding compartments are smaller and smaller as the vanes cannot extend as far, being closer to the outer wall. A higher volume of air compressed into a smaller volume – that’s an air compressor! When the vane-housing volume is the smallest, the air is as compressed as it can be in the cycle, and it’s released through another valve into a receiver or the shop air mains.